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Living alone as a red flag sign of falls among older people in rural Taiwan

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ABSTRACT

Background/Purpose: Fall is a common geriatric syndrome and is associated with physical injuries, fear of falling, limitation of activities of daily living, and increased medical expenditure. Although risk factors of falls have been explored extensively, little is known about the impact of solitary living on falls in the elderly. The main purpose of this study was to evaluate the impact of solitary living on risk of fall among older people who visited the outpatient geriatric services in rural Taiwan.

Methods: From September 2009 to August 2010, all patients who visited the primary care–based outpatient geriatric services were invited for study. For all participants, comprehensive geriatric assessment was performed by a well-trained research nurse. Common risk factors of falls were collected in addition to solitary living, such as polypharmacy (more than four drugs), visual impairment, hearing impairment, age, gender, and cognitive impairment.

Results: Overall, 173 (mean age = 78.8 ± 6.8 years, men = 73.4%) patients were enrolled, and 42 (24.2%) of them reported falls in the past year. Two-thirds of fall events occurred outdoors and mainly (66.7%) during walking. Two-thirds of falls were associated with injuries, and half of the patients reported reduced activities of daily living because of fear of falling. Compared with nonfallers, fallers were significantly more likely to live alone (28.6% *vs.* 14%, $p = 0.031$), but age (79.0 ± 7.2 years *vs.* 78.8 ± 6.8 years, $p = 0.89$); gender (66.7% *vs.* 76.7%, $p = 0.197$); polypharmacy (47.6% *vs.* 39.8%, $p = 0.378$); use of psycotropic agents (4.8% *vs.* 0.8%, $p = 0.096$); visual impairment (35.7% *vs.* 35.7%, $p = 0.995$); hearing impairment (21.4% *vs.* 23.4%, $p = 0.79$); and cognitive impairment (21.4% *vs.* 12.5%, $p = 0.158$) were not statistically significant.

Conclusions: In rural Taiwan, solitary living is an important risk factor of falls among patients who visited primary care–based outpatient geriatric services. Further prospective study is needed to evaluate the impact of solitary living on risk of falls, and improvement of outdoor environment is also of great importance to reduce fall-related injuries.

1. Introduction

Fall is a well-known geriatric syndrome and is a substantial health threat to older people. Approximately 33% of community-dwelling elderly persons may fall at least once a year.[1] Falls may result in increased medical expenditure in terms of increased morbidity and mortality, indirect cost secondary to loss of physical function, and reduced activities of daily living because of fear of falling. Characteristically, fall-related injuries often result from falls. Accidents and injuries are the 10th leading cause of death among people older than 65 years in Taiwan, and falls ranked second in overall mortality caused by accidents and injuries.[2] Most serious adverse impact of falls to the health care system is hip fracture, which may cause 37% of mortality a year later; 35–50% failed to regain prefracture ambulatory status, 20% remained in nonambulatory condition, and only half of all hip fracture patients could return to the communities.[3] Fall was considered an unpreventable condition earlier, but nowadays, it is considered

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preventable and ought to be. Numerous studies have been carried out to identify the risk factors of falls, including older age, gender, polypharmacy, sensory organ impairment, vitamin D deficiency, and many others.[4] However, studies evaluating the impact of living arrangement and risk of falls are scarce. The fall prevention projects of the World Health Organization indicated that any fall prevention or intervention strategy should not ignore the effect of economic status, social engagement, and different culture issues.[5] Solitary-living elders are associated with poorer social engagement, poorer nutritional status, and increased vulnerability to various illnesses that have been classified as high-risk group of morbidity and mortality.[6]

Primary care practice plays an important role in health care systems, which is also known as the gatekeeper of community health and featured by better accessibility and convenience.[7] Previous studies have confirmed the clinical benefits of outpatient geriatric evaluation and management (GEM) services for frail older people,[8–11] but most studies were carried out in hospital settings. One of the main benefits of outpatient GEM services is to identify unrecognized geriatric syndrome and to provide comprehensive geriatric assessment for patients in need. However, population aging results in substantial challenges to health care systems, inclusive of the management of multiple chronic disorders and geriatric syndrome, for example, falls, in older people, and GEM services are highly recommended to provide better quality of care.[12] Although the importance of primary care has been addressed extensively to promote community health, the lack of geriatric training for primary care physicians also raises serious concerns in health care provision. The main purpose of this study was to evaluate the impact of solitary living on risk of falls among community-dwelling elderly in the outpatient GEM services located in a primary care setting in rural Taiwan.

2. Methods

2.1. Study design and outpatient GEM services

This is a cross-sectional study, which was conducted at the outpatient GEM center in Yi-Lan County, a northeastern rural county of Taiwan. The outpatient GEM service was established according to the model introduced by Taipei Veterans General Hospital[8] and is independently operating in the community-based outpatient center. In outpatient GEM services, care by an interdisciplinary team, consisting of a geriatrician, physical medicine and rehabilitation physician, psychiatrist, pharmacist, and case manager, was provided.

2.2. Participants

From September 2009 to August 2010, patients meeting the inclusion criteria of outpatient GEM services were enrolled, and the inclusion criteria were as follows: (1) age $\geq$80 years with any health problem; (2) age $\geq$65 years with three or more comorbid chronic conditions; (3) age $\geq$65 years with complex care needs; and (4) age $\geq$65 years with geriatric syndrome, that is, falls, incontinence, immobility, and decline of cognitive function. For patients who reported falls, further history about falls was taken, including timing and location of falls, activities engaged in when falls occurred, and physical activities after falls.

2.3. Comprehensive geriatric assessment

For all participants, a well-trained nurse performed comprehensive assessment, including assessments of physical function, cognitive function, mood status, past medical and medication history. Demographic characteristics and anthropometric measurements were performed by the research nurse as well. A fall was descried as come to or rest on floor or a lower level unintentionally. Cognitive function was evaluated by Chinese version of Mini-Mental Status Examination, and Mini-Mental Status Examination scores of $<$14 for the illiterate and $<$24 for those who had formal education was defined as cognitive impairment.[13] Medication history was reviewed to evaluate the use of psychotropic drugs and polypharmacy, which is defined as taking more than four drugs.

2.4. Statistical analysis

Continuous variables were expressed by mean $\pm$ standard deviation, and categorical data were expressed by frequency and percentage. In this study, all patients were categorized into four groups according to 5-year age strata (65–69 years, 70–74 years, 75–79 years, 80–84 years, 85 years and older). Statistical analysis was performed using SPSS version 17.0 for Macintosh (SPSS Inc., Chicago, IL, USA). Comparisons of continuous variables were performed by Student t test, and categorical data were compared by Chi-square test when appropriate. Furthermore, one-way analysis of variance was used to evaluate the association between falls and other variables. For all tests, a two-tailed p value $<$0.05 was considered statistically significant.

3. Results

3.1. Demography and risk factors of fall

During the study period, 173 patients (mean age = 78.8 $\pm$ 6.8 years, men = 73.4%) were enrolled, and 42 (24.2%) of them reported recent falls within a year. Compared with nonfallers, fallers were significantly more prone to solitary living (28.6% *vs.* 14%, $p = 0.031$) but insignificant among other factors, including age (79.0 $\pm$ 7.2 years *vs.* 78.8 $\pm$ 6.8 years, $p = 0.89$); gender (male %: 66.7% *vs.* 76.7%, $p = 0.197$); polypharmacy (47.6% *vs.* 39.8%, $p = 0.378$); use of psychotropic agents (4.8% *vs.* 0.8%, $p = 0.096$); visual impairment (35.7% *vs.* 35.7%, $p = 0.995$); hearing impairment (21.4% *vs.* 23.4%, $p = 0.79$); and cognitive impairment (21.4% *vs.* 12.5%, $p = 0.158$) (Table 1). It is not surprising that there was a strong association between age and hearing impairment, and hearing impairment and vision impairment (Table 2). Also, there were significant associations between gender and age, cognitive impairment and hearing impairment, and fall and solitary living.

3.2. Description of falls and associated characteristics

In total, 81 fall events were reported in the past year, and no significant association could be identified between the number of

Table 1
Comparison of clinical characteristics between fallers and nonfallers

Factors	Fallers	Nonfallers	p
Age (y)	79.0 $\pm$ 7.2	78.8 $\pm$ 6.8	0.89
Body height (cm)	159.1 $\pm$ 9.7	160.2 $\pm$ 8.5	0.38
Body weight (kg)	64.3 $\pm$ 13.2	62.2 $\pm$ 11.0	0.793
Education years	3.3 $\pm$ 3.4	4.3 $\pm$ 3.2	0.097
Gender, male	66.7	76.7	0.197
Solitary living	28.6	14	0.031
Cognitive impairment	21.4	12.5	0.158
Polypharmacy	47.6	39.8	0.378
Use of psychotropic drug	4.8	0.8	0.096
Visual impairment	35.7	35.7	0.995
Hearing impairment	21.4	23.4	0.790

Data are presented as mean $\pm$ standard deviation or %.

Table 2
Association between risk factors and fall

Factors	Gender		Solitary living		Cognitive impairment		Visual impairment		Hearing impairment		Fall	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Age	0.25	0.001	−0.059	0.442	0.053	0.489	0.084	0.274	0.291	<0.001	0.003	0.969
Gender	—	—	0.07	0.361	−0.124	0.107	−0.069	0.37	0.038	0.62	−0.099	0.197
Solitary living	—	—	—	—	0.016	0.838	−0.008	0.918	−0.053	0.491	−0.165	0.031
Cognitive impairment	—	—	—	—	—	—	0.0000	0.996	0.17	0.027	0.109	0.158
Visual impairment	—	—	—	—	—	—	—	—	0.201	0.008	0.000	0.995
Hearing impairment	—	—	—	—	—	—	—	—	—	—	−0.021	0.79

reported falls and visual impairment, hearing impairment, cognitive impairment, older age, and gender. Among all fall events, two-thirds caused physical injuries, and half of them lost certain activities of daily living because of fear of falling. Two-thirds of fall events occurred at outdoor environments.

3.3. Psychological impact of fall events

Overall, one-third of the study population developed reduced physical activities after falls, which may be related to fear of falling. Among them, women were more likely to develop reduced activities of daily living after fall incidents (57.1% *vs.* 17.8%, $p = 0.009$). More than 50% of solitary-living patients reported reduced daily activities after falls, which was higher than that of non-solitary-living patients (23%) but not statistically significant.

4. Discussion

Clinical characteristics of patients visiting tertiary medical center and primary care physicians in rural communities differ in various aspects.[14] Although the clinical benefits of outpatient GEM have been reported extensively,[8,15,16] little is known about the clinical benefits of outpatient GEM services located in a community-based primary care center. GEM services are usually provided in hospital settings and are less likely to be provided independently in the communities. To the best of our knowledge, this is the first study of interdisciplinary outpatient GEM service in the primary care setting. Therefore, results of this study support providing geriatric services in primary care settings as an effective model in addition to the accessibility and comprehensiveness. The incidence of fall in this study (20.5%) was similar to that reported from Japan (20%) but was lower than that in China, Australia, and Western countries (mostly around 30%).[17–19] However, this study was conducted in primary care setting; hence, the incidence of fall may be higher than that obtained from community-dwelling elderly. The differences of incidences of falls from different studies may have resulted from geographic factors and the awareness of falls in the older people, and older people living in rural Taiwan may be more conservative in reporting falls.

Compared with reports from Western countries, half of the Japanese fell inside their own homes, which was similar to the report in Taiwan in 1999.[20] However, chances of older people to fall outdoors were progressively increased from 50.1% to 55.4% in Taiwan from 1999 to 2005.[18] This phenomenon was also observed in Australia and China.[21,22] Reducing home environment hazards can significantly prevent falls,[4,23] but the increasing trend of falls in outdoor environment suggests the potential needs of improving the public space of outdoor environments. In 2009, there were 2.4 million persons aged 65 years and older in Taiwan, and about 9.8% of them lived alone.[24] Solitary-living status is strongly associated with falls, which may become a life-threatening condition to them. This enhances the need of fall-prevention programs for these people, and developing an alarm system to identify fall events among them is also important. Developing an effective fall-alert notifying system enables more seniors to live in the communities with higher autonomy and privacy, and minimizes the impact of fall-resulted injuries.[25]

Normal aging is associated with increased reaction time, decreased accommodation and dark adaptation, and weakened muscle power, which are all associative factors of falls.[26] In this study, sensory impairments, such as visual or hearing impairments were not risk factors of falls. However, strategies of preventing falls among older people with sensory impairments were controversial.[27,28] Older people with poor vision and hearing usually are less willing to participate in social activities; hence, are they less likely to fall. Unlike previous reports,[23,29–31] no significant association can be identified between falls and traditional risk factors, for example, polypharmacy, use of psychotropic agents, and cognitive impairment, in this study. This may be explained by the small sample size of this study. On the other hand, the impact of these traditional risk factors, such as age, gender, polypharmacy, use of psychotropic drug, and cognition impairment, on older patients with multiple complex care needs further investigation. In this study, solitary living was the only independent risk factor of falls among older patients with multiple complex care needs. They also tend to suffer from reduced activities of daily living after incident falls, which implies a negative psychological impact, that is, fear of falling. In addition, the negative impact was stronger in women, which was similar to other reports.[32,33]

Several limitations may obscure the clinical implications of this study. First, the clinical characteristics and their existing multiple complex care needs may limit the extrapolation of study results to the general public. Second, because of the cross-sectional design, the causal relationship between falls and risk factors cannot be established. Lastly, most of the study participants were men, which is different from the demography of the general population. However, this may suggest the greater care needs of older solitary-living men. In conclusion, this study highlighted the impact of solitary living among older people with multiple complex care needs in rural Taiwan, and they tend to suffer from reduced activities of daily living resulting from the fear of falling. Further prospective study to evaluate the impact of solitary living on falls and the related fear of falling is needed for clarification.

References

1. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988;**319**:1701–7.
2. Department of Health, Taiwan. Life statistics data. Available from: www.doh.gov.tw/CHT2006/DM/DM2_2_p02.aspx?class_no=440&now_fod_list_no=11397&level_no=-1&doc_no=76512; 2010 (accessed 12.06.11).
3. Lyons AR. Clinical outcomes and treatment of hip fractures. *Am J Med* 1997;**103**:51S–63S. 63S–64S.
4. Anonymous. Summary of the Updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for prevention of falls in older persons. *J Am Geriatr Soc* 2011;**59**:148–57.
5. World Health Organization. Global report on falls prevention in older age. Available from: http://www.who.int/entity/ageing/publications/Falls_prevention7March.pdf; 2007 (accessed 06.06.11).

6. World Health Organization. *Nutrition anemia: report of a World Health Organization scientific group. Technical series no. 405*. Geneva, Switzerland: World Health Organization; 1992.
7. World Health Organization. World health report—2006. Available from: http://www.who.int/whr/2006/06_overview_en.pdf; 2006 (accessed 06.06.11).
8. Lin MH, Liu CL, Peng LN, Chen YT, Chen LK. Demographic characteristics and clinical benefits of outpatient geriatric evaluation and management service in Taiwan. *Arch Gerontol Geriatr* 2011 May 16. [Epub ahead of print].
9. Engelhardt JB, Toseland RW, O'Donnell JC, Richie JT, Jue D, Banks S. The effectiveness and efficiency of outpatient geriatric evaluation and management. *J Am Geriatr Soc* 1996;**44**:847–56.
10. Silverman M, Musa D, Martin DC, Lave JR, Adams J, Ricci EM. Evaluation of outpatient geriatric assessment: a randomized multi-site trial. *J Am Geriatr Soc* 1995;**43**:733–40.
11. Cohen HJ, Feussner JR, Weinberger M, Carnes M, Hamdy RC, Hsieh F, et al. A controlled trial of inpatient and outpatient geriatric evaluation and management. *N Engl J Med* 2002;**346**:905–12.
12. Tinetti ME, Gordon C, Sogolow E, Lapin P, Bradley EH. Fall-risk evaluation and management: challenges in adopting geriatric care practices. *Gerontologist* 2006;**46**:717–25.
13. Guo NW, Liu HC, Wong PF, Liao KK, Yan SH, Lin KP, et al. Chinese version and norms of the mini-mental state examination. *Taiwan J Phys Med Rehabil* 1988;**16**:52–9.
14. Manzoor I, Hashmi NR, Mukhtar F. Determinants and pattern of health care services utilisation in post graduate students. *J Ayub Med Coll Abbottabad* 2009;**21**:100–5.
15. Rubin CD, Sizemore MT, Loftis PA, de Mola NL. A randomized, controlled trial of outpatient geriatric evaluation and management in a large public hospital. *J Am Geriatr Soc* 1993;**41**:1023–8.
16. Boult C, Boult LB, Morishita L, Dowd B, Kane RL, Urdangarin CF. A randomized clinical trial of outpatient geriatric evaluation and management. *J Am Geriatr Soc* 2001;**49**:351–9.
17. World Health Organization. Fall prevention project for older ages, from regional office for the West Pacific. Available from: http://www.who.int/entity/ageing/projects/WPRO.pdf; 2007 (accessed 06.06.11).
18. Bureau of Health Promotion, Taiwan. National health interview survey. Available from: http://www.bhp.doh.gov.tw/bhpnet/portal/Them_Show.aspx?Subject=200712270001&Class=2&No=200712270007; 2005 (accessed 06.06.11).
19. National Center for Health Statistics. United States, with chart book on trends in the health of Americans. Available from: http://www.cdc.gov/nchs/data/hus/hus07.pdf#027; 2007 (accessed 06.06.11).
20. Asada T, Kariya T, Kinoshita T, Asaka A, Morikawa S, Yoshioka M, et al. Predictor of fall-related injuries among community-dwelling elderly people with dementia. *Age Ageing* 1996;**25**:22–8.
21. Hill K, Schwarz J, Flicker L, Carroll S. Falls among healthy, community-dwelling, older women: a prospective study of frequency, circumstances, consequences and predication accuracy. *Aust N Z J Public Health* 1999;**23**:41–8.
22. Li L, Wang S, Jing C. A study on risk factors for falls in older people. *Chin J Dis Control Prev* 2001;**5**:227–9.
23. Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N Engl J Med* 1994;**331**:821–7.
24. Ministry of Interior Department. National elderly welfare survey. Available from: http://www.moi.gov.tw/files/news_file/week10011.doc; 2011 (accessed 06.06.11).
25. Hamill M, Young V, Boger J, Mihailidis A. Development of an automated speech recognition interface for personal emergency response systems. *J Neuroeng Rehabil* 2009;**6**:26.
26. Tinetti ME, Williams CS. The effect of falls and fall injuries on functioning in community-dwelling older persons. *J Gerontol A Biol Sci Med Sci* 1998;**53**:M112–9.
27. Campbell AJ, Robertson MC, La Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ, et al. Randomised controlled trial of prevention of falls in people aged $>$ or $=$75 with severe visual impairment: the VIP trial. *BMJ* 2005;**331**:817.
28. Cumming RG, Ivers R, Clemson L, Cullen J, Hayes MF, Tanzer M, et al. Improving vision to prevent falls in frail older people: a randomized trial. *J Am Geriatr Soc* 2007;**55**:175–81.
29. French DD, Campbell R, Spehar A, Cunningham F, Bulat T, Luther SL. Drugs and falls in community-dwelling older people: a national veterans study. *Clin Ther* 2006;**28**:619–30.
30. Leipzig RM, Cumming RG, Tinetti ME. Drugs and falls in older people: a systematic review and meta-analysis: I. Psychotropic drugs. *J Am Geriatr Soc* 1999;**47**:30–9.
31. Lamoth CJ, van Deudekom FJ, van Campen JP, Appels BA, de Vries OJ, Pijnappels M. Gait stability and variability measures show effects of impaired cognition and dual tasking in frail people. *J Neuroeng Rehabil* 2011;**8**:2.
32. Murphy SL, Dubin JA, Gill TM. The development of fear of falling among community-living older women: predisposing factors and subsequent fall events. *J Gerontol A Biol Sci Med Sci* 2003;**58**:M943–7.
33. Arfken CL, Lach HW, Birge SJ, Miller JP. The prevalence and correlates of fear of falling in elderly persons living in the community. *Am J Public Health* 1994;**84**:565–70.